

New Approach to Near-Infrared Remote Sensing using Video Camera

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In the satellite remote sensing, the near-infrared (NIR) images are useful for the studies of the vegetation coverage of the earth surface and the topographies of mountains and rivers in various scales. Recently, works on NIR photography have been reported by using digital still-camera removing IR-cut filter and video camera with the night-shot function, as cited in Kinoshita et al., CEReS Symposium, Dec. 2003. In these works, the IR filter is attached to cut-off visible light. We report here new aspects of ground and air based NIR photography.

1. Detection of aerosol invisible in naked eyes

In the NIR observation by using the night-shot mode of a video camera with IR filter, we may avoid over exposure in the daytime by using strong ND filter, and detect faint volcanic plume aerosol almost invisible in naked eyes and ordinary photos. This is due to the scattering of NIR light by sulfuric aerosol in the dry air and/or suspended particulate matter, with the dark background of fine sky. This is similar to the situation in detecting volcanic plumes at Miyakejima in the NIR and the NIR-Vis difference images of NOAA/AVHRR with the dark sea background. Combining the NIR and visible light recordings, we may study Asian dust in the air and atmospheric pollutions.

2. Clairvoyant observation from the ground and the air

In the naked eyes and ordinary photos, it is very hard to observe the structure of Kirishima volcanoes from 48 km away at Kagoshima city, except for the boundary with the sky. In the NIR view, for which the air is rather transparent, we may observe the surface structure and monitor the plume activity in the close-up view. The NIR observation may be useful for the monitoring of Suwanosejima volcano from Nakanoshima 25 km away, in contrast to ordinary hazy view.

NIR observation by a handy video camera can be done from the airplane, where we can enjoy clear view of the topography and vegetation extending a few hundred km away, in contrast to the misty view in the naked eyes. The NIR photos can be compared with the 3D representation of satellite images by using the SiPSE system.

3. Automatic recordings for a hundred days

In the interval recordings of 0.5 sec/ an hour of a video camera, we may obtain NIR movies for a hundred days in a cassette. ND filter is necessary for the aerosol detection in the daytime, while it is better to take off for the detection of hot anomalies in the nighttime and aerosol detection in the twilight, as we have experienced at Sakurajima and Sutsuma-Iwojima, where we have started NIR web-camera monitoring as seen in <http://arist.edu.kagoshima-u.ac.jp/volc/iwo/>. We are planning the NIR observation of Mayon volcanoes in the Philippines by a IR sensitive network camera with auto-iris and IR filter.

The following methods of the ground-based remote sensing are now under study:

- i) The long-term automatic observation near a crater without AC power supply by using the interval recording function of the digital still-camera with Lithium-ion rechargeable battery.
- ii) Kite aerial photography using movie recording function of the mobile phone camera (CCD: megapixel, weight: 100g, time: 30min).
- iii) Super-wide-angle observation using hemispherical mirror (or large metal spoon) of the whole sky and the extension of volcanic clouds at Sakurajima.